



AQUATIC BIOINDICATORS OF LOHIT RIVER FOR WATER QUALITY ASSESSMENT

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ABSTRACT

The study was conducted on Lohit River for consecutive two years which is transboundary to Arunachal Pradesh and Assam of India. The observations recorded seasonal variations of macroinvertebrates richness, which serves as a bioindicator. Collected macroinvertebrates falling under the phyla Arthropoda and Mollusca, revealed 13 orders, 35 families, and 38 species. The biotic indices like Shannon-Weiner diversity index, Simpson's diversity index, Margalef richness index, Sorensen's similarity index have shown relatively better quality of water. The calculated BMWP, ASPT and FBI score highlighted the healthy condition of the aquatic ecosystem. The study shows a complex but stable ecosystem during the study.

KEYWORDS: Macroinvertebrates, Bioindicator, Diversity, Transboundary

INTRODUCTION

In nature River contains a delicate ecology which interacts with physical, chemical components of biotic and abiotic components. The water quality assessment of river important composition of interaction of river biota and their hydro-geochemical environment. Anthropogenic activities have strong effects on aquatic ecosystems leading to widespread modification of the physical habitat and consequently of biotic communities and ecological functioning. The biological communities of river ecosystem specially the aquatic macroinvertebrates play an important role for water quality assessment. Macroinvertebrates and water quality are interrelated to each other, as macroinvertebrates are a potential indicator of water quality. Such organisms have specific requirements in terms of physical and chemical conditions. Changes in presence/absence, numbers, morphology, physiology or behaviors of these organisms can indicate that the physical and/or chemical conditions are outside their preferred limits. The presence of numerous families of highly tolerant organisms usually indicates poor water quality. Biological assessment and criteria can be used as the basis for management programs, restoring and maintaining the chemical, physical and biological integrity of freshwater. Live organisms offer valuable information regarding their surrounding conditions and can be used to evaluate the physical, chemical and biological impact and their cumulative effects. Different taxa have different habitat preferences and pollution tolerances. Absence of sensitive species and presence of tolerant ones indicate water quality determination.

The Study is conducted for water quality assessment of river Lohit. Lohit is a major river in Northeast region of India, and it is an important tributary to Brahmaputra River Basin. The river rises in eastern Tibet where it is known as Zayul Chu. It flows through China to India, descends through mountainous region and surges through Arunachal Pradesh in India for two hundred kilometers. Before entering the plains of Assam, it

merges with other two transboundary rivers Dihang and Dibang and is called Brahmaputra River in Assam. The river Lohit is a lifeline for the state of Arunachal Pradesh and Assam and good habitat for large number of aquatic faunae. Qualitative and quantitative assessment of aquatic insect community will enrich the aquatic fauna database and reflect the water quality status. A comprehensive study was done to portray a vivid picture of river ecosystem considering the aquatic macroinvertebrates as bio indicator.

MATERIALS AND METHODS

For assessment of water quality of Lohit, the study was conducted seasonally (pre-monsoon, monsoon, post-monsoon and winter) in four sampling stations for a period of two consecutive years 2019 to 2021. The present work aims at assessment of biological condition of Lohit River through biomonitoring by macroinvertebrate to get an idea of the river water quality.

Study area

For selection of study area river Lohit is divided into four sampling stations. The stations are in Alubari region. *Station 1*- 27° 50' 22" N latitude and 96° 00' 47" E longitude with altitude of 156m, *Station 2*- 27° 51' 09" N latitude and 96° 01' 30" E longitude with altitude of 156m, *Station 3*- 27° 46' 41" N latitude and 95° 40' 35" E longitude with altitude of 131m, *Station 4*- 27° 46' 44" N latitude and 95° 40' 30" E longitude with altitude of 131m.

Sample Survey

For sample survey water samples were collected in the middle of river and stored in clean sampling bottles. Kick nets and "D" framed nets were used for the collection of the specimens with a mesh size of 0.5–1 mm². Small specimens were carefully picked up from the net sampler using soft brushes and forceps. Specimens were washed carefully and transferred to separate

sample collection containers. Containers were properly labeled with site code and dates and finally brought to the laboratory and preserved in 70% ethanol for future references. Collected aquatic macroinvertebrates were identified based on morphological characters following, and, along with the information available in the online databases (India Biodiversity Portal).

RESULTS

The results of the study are discussed on the following points.

1. Diversity of Macroinvertebrate Communities in River Lohit

During the two years of study a total of 9,646 individuals, representing 13 orders, 35 families and 38 genera were encountered. In the study phylum Arthropoda and Mollusca were observed and the orders of macroinvertebrates recorded were Ephemeroptera, Trichoptera, Placoptera Hemiptera, Coleoptera, Odonata, Megaloptera, Diptera, Crustacea, Sorbeoconcha, Hygrophila, Architaniglossa and Unoidea. The macroinvertebrates of Lohit River are mainly dominated by Trichoptera and Ephemeroptera.

2. Diversity Indices

For Diversity index of biological species Diversity Shannon-Weiner diversity index, Simpson's diversity index, Margalef richness index, Sorensens similarity index are applied on different sample stations of Lohit River during both the years. During the study the diversity indices of macroinvertebrates were calculated to reflect the ecological status of the River Lohit. Shannon-Weiner index "H" which depends on both the number of species present, and the abundance of each species and the range of Shannon index (H) value was found (1.04-2.03). The macroinvertebrates present in all the sampling stations of Lohit are evenly distributed as calculated value is closer to 1 (0.17-0.92). The range value of Simpson's Index of Dominance (D) was (0.02-0.49) and the range of Simpson's index of diversity (1-D) was (0.51-0.8). The Margalef index value ranged (1.64-3.003). Based on different diversity, species richness and similarity index the river Lohit may be considered healthy as Margalef's index value greater than or closer to 3.00, indicates clean conditions. (Table-1)

Sl. No.	Diversity Index	Range of Diversity Index
1	Shannon wiener index	1.04-2.03
2	Evenness	0.17-0.92
3	Simpson's index	0.02-0.49
4	1-D	0.51-0.8
5	1/D	2.05-6.02
6	Margalef index	1.64-3.003

Table 1: The range of of Diversity indices values of macroinvertebrate population of Lohit River from March 2019 to February 2021

3. BMWP and ASPT

The BMWP (Biological Monitoring Working Party) score and ASPT have shown the better quality of water of the River Lohit. From the score of BMWP of four sampling

stations of Lohit River in four seasons, it was found that all the scores were above 100 which indicates very good biological quality of water except monsoon. During monsoon the scores were 94 and 97 which also included good water category (clean but slightly impacted). The ASPT score of four stations in different seasons above 6.3. It also determines that excellent water quality of Lohit River. (Table-2)

Sl. No.	Seasons	BMWP Score		ASPT	
		2019-2020	2020-2021	2019-2020	2020-2021
1	Pre monsoon	157	164	6.82	7.13
2	Monsoon	94	97	6.71	6.46
3	Post monsoon	108	124	6.35	6.52
4	Winter	110	115	6.47	6.76

Table 2: The BMWP and ASPT of River Lohit

4. FBI (FAMILY BIOTIC INDEX) OF RIVER LOHIT

From the recorded data Family Biotic Index was calculated and FBI have shown relatively better quality of water of the River Lohit. The FBI of sampling station 1 and 2 was 3.45 and 3.25 respectively which indicate Excellent water quality and the FBI of sampling station 3 and 4 was 3.9 and 3.87 respectively which indicate water quality is Very good.

Sampling Stations	FBI Value	Water Quality	Degree of Organic Pollution
Station 1	3.45	Excellent	Organic pollution unlikely
Station 2	3.25	Excellent	Organic pollution unlikely
Station 3	3.9	Very good	Possible slight organic pollution
Station 4	3.87	Very good	Possible slight organic pollution

Table 3: Family Biotic Index of Lohit River

DISCUSSION

The use of living organisms for monitoring of water quality originated in Europe and it is widely used throughout the world. developed methods and used macroinvertebrates as indicators of ecological conditions for streams in the Mid -Atlantic Highland region. Experiences from USA and from European programme have demonstrated that benthic macroinvertebrates are most useful in monitoring freshwater ecosystem. Generally, within macroinvertebrate taxonomic groups, members of Ephemeroptera (mayfly), Plecoptera (stonefly) and Trichoptera (caddisfly)-(EPT) are widely accepted bioindicators in the light of bioassessment programs because of their relative abundance in a wide variety of substrates and their graded sensitivity to various environmental stressors and pollution . impacts. Their occurrence, distribution and composition are highly influenced by various physical, chemical or environmental variables. During the study period the presence of (EPT), Ephemeroptera

(mayfly), Plecoptera (stonefly) and Trichoptera (caddisfly) indicates good water quality of Lohit River.

From the point of different diversity, species richness and similarity index the river Lohit, it may be considered healthy as Margaleff's index value greater than or closer to 3.00, which indicates clean conditions of the river. By calculating the score of BMWP of four sampling stations of Lohit River it was found that the scores of Samplings Station1, Sampling Station 2, Sampling Station 3 and Sampling Station 4 were above 100-164 range (except monsoon season) which indicates Good biological quality of water. The ASPT score of four stations was also above 4.81-5.4 range. It also determines that excellent water quality of Lohit River. By calculating the FBI we found that Station 1 & 2 both situated in Alubari region the water quality is Excellent. Station 3 & 4 situated in Dholia – Sadiya region also showed Very good.

CONCLUSION

This study is a glimpse of ecological health assessment of River Lohit by aquatic macroinvertebrates. The study covers health status through the inter relationship by macroinvertebrate distribution. For this purpose, a detailed long-term study is needed which might help with the innovation of new species and new concepts. Sand and gravel mining activity and their transportation is one of the negative factors for river health. These activities not only deteriorate water quality but also change the composition and diversity of aquatic communities. Hence proper management intervention and awareness is needed for arresting further degradation of this mighty dynamic freshwater ecosystem.

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